Assignment 1

Sri Seshadri

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# Problem 1

## Decision Variable:

= number of servings of category and item . Where and for is such that ; for is such that and for is such that

## Objective function

If the cost for each item is denoted by , then the objective function can be

### in explicit form

## Constraints

Let Carbs for item be ; likewise vitamins be ; Protein be ; Fat be

Minimal requirement for Carbs in diet Minimal requirement for Vitamins Minimal requirement for protein Minimal requirement for fat

Atleast one equivalent serving per category

, ,

### constraints in explicit form

# Problem 2

## Decision Variable:

= Tons of fuel of type used in plant

## Other variables:

= Total energy used in plant j BTU/day

= effluent emission per ton of fuel type at plant

= cost per ton of fuel of type

= BTU generated at plant using one ton of fuel of type

## Objective function:

## Constraints:

Total energy needed in a plant :

Air pollution per region constraint:

Non-negative constraints:

# Problem 3

## Decision variables:

,, and be the numbers of products A,B,C and D respectively to be produced.

## Objective function:

## Constraints:

Contractual constraints and non -negative constraints on the number to be produced:

; ; ;

Production time constraints:

# Problem 4(a)

subject to

let r =

let

## Therefore objective function is :

Now in terms are r can be written as :

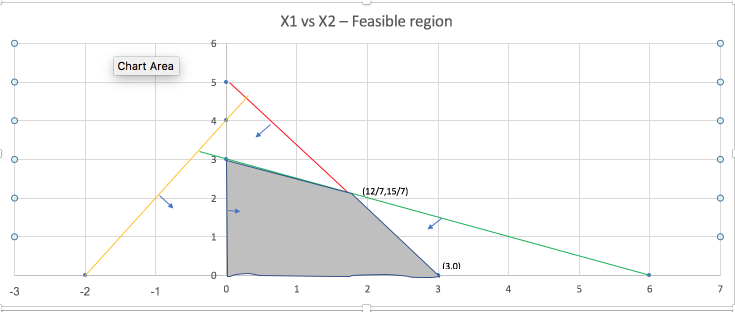
## Rewritting the first constraint in terms of y

## likewise the second constraint is

# Problem 4(b)

## Objective :

## subject to



Graphical method for LP solution

### The objective function is maximized at (12/7,15/7) yielding a value of 17.14.

# Problem 5

## Decision variables :

and as number of stocks to be invested in stock 1 through 4 respectively.

## Objective :

-> minimum risk investment investment

## Subject to

### Total investment constraint:

let

### at least 10% return constraint

if we let ; ; and

then

### at least 10% of investment in Stock 4

or

## Non negative constraints

and

### re-write objective

# Extra credit

The objective is to maximize , where

Subject to ,

if $ then we have an unbounded constraint as shown below as a red line. Hence any point other than infinite would not be optimal.

if then x would be maximum when there by increasing the objective function . Any point such that would be less than when . Hence cannot be the optimal point. This scenario is illustrated by the black line in the plot below with b as a positive upper boundary condition.

